Atmos. Meas. Tech. Discuss., 4, C726–C728, 2011
www.atmos-meas-tech-discuss.net/4/C726/2011/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Analysis of vertical wave number spectrum of atmospheric gravity waves in the stratosphere using COSMIC GPS radio occultation data" *by* T. Tsuda et al.

Anonymous Referee #2

Received and published: 30 May 2011

'Analysis of vertical wave number spectrum in atmospheric gravity waves in the stratosphere using COSMIC GPS radio occultation data': T. Tsuda, X. Lin, H. Hayashi and Noersomadi

Summary:

The authors analyse COSMIC temperature profiles using the full spectrum inversion (FSI) technique, which they validate against Malaysian and North American radiosonde data. The authors then study the vertical wavenumber spectrum obtained from both the FSI method and the standard geometrical optics method where they demonstrate close agreement with model spectra, a noise floor at large vertical wavenumbers and

subsequently estimate the limitations of the FSI technique. They reveal the applicability of FSI up to about 28km altitude with higher vertical resolution (around 500m) than using the geometrical optics method.

This Atmos. Meas. Tech. Discuss. paper presents new and interesting results which determine that COSMIC FSI temperature data can be used to study finer-scale vertical structures. I recommend that this paper be published in Atmos. Meas. Tech. subject to the authors incorporating the following minor corrections.

Minor Comments:

One of the limitations in observing the atmosphere is the fact that an instrument can only see part of the gravity wave spectrum. The authors mention this in the last sentence of the conclusion (page 2085, line 18-22) in the context of horizontal wave number. I think that this could be expanded upon earlier in the paper to make it clear to readers that only part of the spectrum is observable. This will place these new GPS results in the context of other observations and therefore strengthen the manuscript. A specific mention of the horizontal wavelengths or wavenumbers observable by GPS would be appropriate to make (based on e.g. Fig 9, Preusse et al. 2008). Recent COSMIC observations have demonstrated that differences in closely spaced (in space and/or in time) profiles of temperature can be attributed to real geophysical variability (i.e. gravity waves, McDonald et al. 2010), which may well account for some of the (minor) variability seen between radiosondes and GPS. These results point to the utility of extracting these gravity waves visible in GPS radio occultation data, thus lending further weight to the FSI extraction of high vertical resolution results presented here.

Technical Corrections:

1) P2076, line 1: '. . . become a serious problem because of a sharp. . .'

2) P2078, line 22: '. . . propagated northward over these sites.'

3) P2078, line 27: 'United'

4) P2082, line 14 '. . . then the origin. . .'

5) P2084, line 14. Remove the word 'quite' because GPS radio occultation has already been demonstrated by many authors to be very promising and useful.

6) Figure 4, LHS title spelling 'Number of Pairs'

7) Figure 4, RHS x-title add in 'Temperature Difference (K)'

8) Figure 7, caption first line: I think that it should be '. . .20{deg}S. . .'

9) Figure 8 box spelling should be 'wavelengths'

10) Figure 9. I suggest using a different colour for the number of profiles (e.g. black). Please mention in the caption which lines are which.

References:

Preusse, P., S. D. Eckermann, and M. Ern (2008), Transparency of the atmosphere to short horizontal wavelength gravity waves, J. Geophys. Res., 113, D24104, doi:10.1029/2007JD009682

McDonald, A. J., B. Tan, and X. Chu (2010), Role of gravity waves in the spatial and temporal variability of stratospheric temperature measured by COSMIC/FORMOSATâĂŘ3 and Rayleigh lidar observations, J. Geophys. Res., 115, D19128, doi:10.1029/2009JD013658

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 2071, 2011.